SECTION 32 31 13

CHAIN LINK FENCES AND GATES

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Fencing and gate materials.

B. Concrete.

C. Fence and gate installation.

D. Electrical grounding.

1.02 MEASUREMENT AND PAYMENT

A. General: Measurement and payment for chain-link fences and gates will be either by the lump-sum method or by the unit-price method as determined by the listing of the bid item for chain-link fences and gates indicated in the Bid Schedule of the Bid Form.

B. Lump sum: If the Bid Schedule indicates a lump sum for chain-link fences and gates, the lump-sum method of measurement and payment will be in accordance with Section 01 20 00, Price and Payment Procedures, Article 1.03.

C. Unit price: If the Bid Schedule indicates a unit price for chain-link fences and gates, the unit-price method of measurement and payment will be as follows:

1. Measurement:

   a. Chain link fences will be measured for payment by the linear foot of each type and height complete in place, parallel to finished grade, from center to center of end posts.

   b. Gates, including gate hardware, will be measured for payment by the number of each type and size of gate installed complete in place.

   c. Earthwork, grout and concrete, barbed wire, metal closures to ground, and electrical grounding will not be measured separately for payment, and all costs therefore will be considered to be included in the measurements for chain link fences and gates.

2. Payment: Chain-link fences and gates will be paid for at the indicated Contract unit prices for the computed quantities as determined by the measurement method specified in Article 1.02.C.1.

1.03 FENCE CLASSIFICATIONS AND STANDARDS

A. Fence Code: Type of fence, dimensions, components, gates, and accessories are indicated on the Contract Drawings in accordance with the "Fence Code" on the Civil Standard Drawings and/or the Contract Drawings.

B. Fence Types: Chain link fencing shall be of the types indicated as follows unless otherwise specified in the Contract Documents:

1. Type CL — Zinc-coated steel fence fabric with galvanized steel posts, rails, caps, hardware, and fittings.

2. Type VCL — Polyvinyl chloride (PVC) coated steel fence fabric with vinyl-coated and factory-painted steel posts, rails, caps, hardware, and fittings in selected color.

3. Type RP — Type CL fence with redwood slats or pickets inserted vertically in the fence fabric.

C. Fence Fabric Standard Size: No. 9 gage chain link steel wire woven into one-inch diamond mesh unless otherwise specified in the Contract Documents.

D. Area Fence Standards:

1. BART Fencing: Materials, dimensions, and components of fencing are indicated on the Contract Drawings by means of a "Fence Code." If no code is indicated, the fence shall be galvanized chain-link fabric, posts, and accessories, as follows: fabric shall be 84 inches wide, secured at the top and bottom to tension wire, with three strands of barbed wire carried on extension arms above the fabric for an additional 12 inches, for a total height above ground of 96 inches.

2. Substation Yard Fencing: Materials, dimensions, and components of the fencing are indicated on the Contract Drawings. The fence shall be galvanized chain-link fabric, posts, and accessories, as follows: fabric shall be 96 inches wide, secured at the top and bottom to galvanized pipe rail, plus three strands of barbed wire carried on extension arms above the top rail, for a total height of 108 inches above ground.

1.04 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM A53 — Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

2. ASTM A121 — Specification for Zinc-Coated (Galvanized) Steel Barbed Wire

3. ASTM A123 — Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

4. ASTM A153 Specification for Zinc-Coating ((Hot-Dip) on Iron and Steel Hardware

5. ASTM A392 Specification for Zinc-Coated Steel Chain-Link Fence Fabric

6. ASTM A491 Specification for Aluminum-Coated Steel Chain-Link Fence Fabric

7. ASTM A526 Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality

8. ASTM A569 Specification for Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip Commercial Quality

9. ASTM A752 Specification for General Requirements for Wire Rods and Coarse Round Wire, Alloy Steel

10. ASTM A824 Specification for Metallic-Coated Steel Marcelled Tension Wire for Use with Chain Link Fence

11. ASTM B117 Method of Salt Spray (Fog) Testing

12. ASTM F567 Practice for Installation of Chain-Link Fence

13. ASTM F626 Specification for Fence Fittings

14. ASTM F668 Specification for Poly (Vinyl Chloride) (PVC)-Coated Steel Chain-Link Fence Fabric

15. ASTM F900 Specification for Industrial and Commercial Swing Gates

16. ASTM F934 Specification for Standard Colors for Polymer Materials Coated Chain-Link Fence

17. ASTM F1083 Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures

B. Chain Link Fence Manufacturers Institute (CLFMI): CLFMI Publication, "Standards for Chain Link Fence Installation"

C. Federal Specifications:

1. RR-F-191/2C Fencing, Wire and Post, Metal (Chain Link Fence Gates) (Detail Specification)

2. RR-F-191/4C Fencing, Wire and Post, Metal (Chain Link Fence Accessories) (Detail Specification)

1.05 SUBMITTALS

A. General: Refer to Section 01 33 00, Submittal Procedures, and Section 01 33 23, Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.

B. Product Data: Submit manufacturer's product data and specifications of the specified chain link fencing and gates.

C. Shop Drawings: Submit detailed Shop Drawings of the fences and gates layout, including installation details of the fencing, posts, gates, hardware, and accessories for review.

D. Samples: If PVC-coated fencing is indicated or specified, submit manufacturer's color chart of available colors and physical sample of selected color.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Requirements: Fencing shall include fabric covering, framework, barbed wire, razor coil when specified in the Contract Documents and supporting arms, concrete footings, gates, hardware, and all appurtenances and accessories as required for a complete installation. Heights of fences shall be as indicated. When not indicated, line fencing and substation fencing shall conform with the Area Fence Standards specified herein in Article 1.03.

B. Fence Fabric:

1. Type CL Fence Fabric: Zinc-coated steel fabric conforming to ASTM A392 with Class 2 coating. Mesh size one-inch square fabricated No. 9 gage wire unless otherwise specified in the Contract Documents.

    a. The Contractor may furnish aluminum-coated steel fence fabric conforming to ASTM A491, with one-inch square mesh size fabricated No. 9 gage wire unless otherwise specified in the Contract Documents.

2. Type VCL Fence Fabric: Type CL fence fabric, PVC-coated in accordance with ASTM F668. Class 1, Class 2a, and Class 2b wire and fabric types are acceptable. Mesh size one-inch square fabricated No. 9 gage wire unless otherwise specified in the Contract Documents. Color shall be as selected by the Engineer from manufacturer's standards, as specified in ASTM F934.

3. Type RP Fence Fabric: Type CL fence fabric, mesh size two-inch square, with California redwood slats or pickets inserted vertically through the mesh pattern. Redwood fence slats or pickets shall be nominal one inch by three eighths inch in size, and shall have stain applied to all surfaces in color as selected by the Engineer. Slats shall be one piece, full height of fence fabric.

4. Selvages: Twisted and barbed at top and bottom selvages when barbed wire is used; knuckled at both selvages when barbed wire is not used; unless otherwise indicated.

C. Pipe Framework for Type CL and RP Fencing: Posts and rails shall be standard weight galvanized steel pipe conforming to ASTM F1083. Sizes and weights shall be as follows unless otherwise specified in the Contract Documents:

1. End and Corner Posts: Minimum nominal outside diameter of 2.875 inches, weighing not less than 5.79 pounds per linear foot, for end, corner, and gate posts for gates six feet wide and smaller. Gate posts for gate leaves from 6 feet to 13 feet wide shall have minimum nominal outside diameter of 4.000 inches, weighing 9.11 pounds per linear foot.

2. Line Posts: Nominal outside diameter of 2.375 inches, weighing not less than 3.65 pounds per linear foot.

3. Rails and Braces: Nominal outside diameter of 1.660 inches, weighing not less than 2.27 pounds per linear foot. Posts shall include galvanized bolted fittings to properly secure rails and braces to posts.

D. Under BART's direction, Alternate Pipe Framework for Type CL and RP Fencing as shown below may be used:

1. Pipe for Posts and Rails: Posts and rails shall be high-strength pipe manufactured from steel conforming to ASTM A569, cold-formed, high frequency or induction welded, and having a minimum yield strength of 50,000 psi.

2. End and Corner Posts: Minimum nominal outside diameter of 2.875 inches, weighing not less than 4.64 pounds per linear foot, for end, corner, and gate posts for gates six feet and smaller. Gate posts for gate leaves from six feet to 13 feet wide shall have minimum nominal outside diameter of 4.000 inches, weighing not less than 6.56 pounds per linear foot.

3. Line Posts: Nominal outside diameter of 2.375 inches, weighing not less than 3.12 pounds per linear foot.

4. Rails and Braces: Nominal outside diameter of 1.660 inches, weighing not less than 1.84 pounds per linear foot. Posts shall include galvanized bolted fittings to properly secure rails and braces to posts.

5. External Pipe Coating: External surface shall be triple coated with one ounce plus or minus 0.1 ounce of zinc per square foot, 30 plus or minus 15 micrograms of chromate per square inch, and a high-performance polymer. Pipe shall demonstrate the ability to resist 1,000 hours of exposure to salt spray with a maximum of five percent red rust when tested in accordance with ASTM B117.

6. Internal Pipe Coating: Internal surface of pipe shall be coated, after welding, with a zinc-rich based organic coating having a 91 percent zinc powder loading capable of withstanding 650 hours of exposure to salt fog with a maximum of five

percent red rust when tested in accordance with ASTM B117. All coatings shall be applied inside and out after welding.

E. Pipe Framework for Type VCL Fencing: Post and rails shall be vinyl-clad steel with color-coated EMV (epoxy modified polyvinyl chloride) chemically bonded to heated standard weight ASTM F1083 galvanized steel pipe, as specified, by electrostatically applied powder coating process. Protective vinyl coating thickness shall be 10 to 14 mils, according to pipe diameter. Pipe vinyl coating shall have the following properties: specific gravity of 1.32 to 1.37; tensile strength of 2,000 psi; minimum elongation of 180 percent; tear strength at 15 mils -0.36 pounds per mil; hardness of coating of 87 to 92 Shore A Durometer. Color shall match fence fabric color. Sizes and weights shall be as specified for Type CL fence or alternate high-strength pipe framework.

F. Tension Wire: Tension wire for top and bottom edge support of fence fabric shall be No. 7 gage steel wire, conforming to ASTM A824, Class 3, with minimum tensile strength of 80,000 psi, zinc-coated wire with zinc coating of not less than 0.80 ounce per square foot. For type VCL fencing, provide tension wire coated with PVC, matching fence fabric in color.

G. Post Caps and Fittings: Manufacturer's standard, pressed steel or malleable iron post caps, fittings, and accessories, meeting requirements of ASTM F626 and Federal Specification RR-F-191/4C, galvanized for Type CL and RP fencing, and PVC coating by the thermal-fusion-bond process, in color matching posts, for Type VCL fencing. Post caps shall be designed to fit securely over the posts to exclude water and to carry the top pipe rail and extension arms, where indicated. All other required fittings and hardware shall be provided to fasten to the pipe posts or concrete in the manner indicated.

H. Truss Rods: Alloy steel rods conforming to ASTM A752, with minimum tensile strength of 80,000 psi, and minimum diameter of five eighths inch. Provide rods with threaded ends and self-tightening galvanized turnbuckles and anchor plates. Secure anchor plates to posts and gate frames by welding.

I. Tension Bars: Provide one-piece lengths equal to full height of fabric with a minimum cross-section of one fourth inch by three eighths inch. Provide one stretcher bar for each gate and end post, and two for each corner and pull post.

J. Tension Bar Bands: Provide galvanized heavy pressed steel or malleable iron bands with a minimum cross section of one eighth inch by three fourths inch, spaced not over 15 inches on center, to secure stretcher bars to end, corner, pull, and gate posts.

K. Accessories: Provide miscellaneous materials and accessories, clips, tie wires (nine gage), anchors, and fasteners as required for a complete installation. All items shall be galvanized in accordance with ASTM A123 or ASTM A153 as applicable. Accessories for Type VCL fencing shall be vinyl-coated or painted to match color of fence fabric.

L. Barbed Wire Extension Arms: Pressed steel conforming to ASTM A526, hot-dip galvanized after fabrication, complete with provision for anchorage to end, corner,

and pull posts and for attaching three rows of barbed wire to each arm. Arms shall be 45-degree angle or vertical as indicated, for three strands of barbed wire. Arms shall be integral with post top weather cap. Intermediate arms shall have hole for passage of top tension wire. Arms shall be capable of withstanding 300 pounds downward pull at outermost end of arm without failure. Arms for Type VCL fencing shall be vinyl-coated or painted to match color of fence fabric.

M. Barbed Wire: Three-strand, zinc-coated, 12-1/2 gage steel wire with 14 gage, four-point steel barbs spaced five inches apart, conforming to ASTM A121. Zinc coating shall be Class 3, 0.80 ounce per square foot for 12-1/2 gage wire and 0.65 ounce per square foot for 14-gage wire.

N. Gates: Gates shall be swinging type or sliding type as indicated, furnished complete with all hardware and accessories as required for a complete installation.

1. Gate Frames: Frames shall be fabricated from zinc-coated steel pipe members (to match posts in Type CL and RP fencing) having a minimum outside diameter of 1.900 inches and weighing not less than 2.72 pounds per linear foot unless otherwise specified in the Contract Documents.

2. Fabrication: Conform to applicable requirements of ASTM F900, Federal Specification RR-F-191/2C, and the following:

   a. Assemble gate frames by welding or with fittings and rivets for rigid connections. Use same fabric as for fence. Install fabric with stretcher bars at vertical edges, and tie wires at top and bottom edges. Attach stretcher bars to gate frame at not more than 15 inches on center. Attach hardware with rivets or by other means that will provide security against removal or breakage.

   b. Provide additional horizontal and vertical members to ensure proper gate operation and for attachment of fabric, hardware, and accessories.

   c. Provide diagonal cross bracing consisting of minimum one half-inch diameter adjustable length truss rods on gates where necessary to provide frame rigidity without sag or twist.

   d. For Type VCL fencing, gate components shall be PVC-coated or painted in color matching fence fabric.

3. Gate Hardware:

   a. Swinging Gates: Provide gate hinges, latch, stop, and keeper for each gate leaf, conforming to applicable requirements of ASTM F900 and Federal Specification RR-F-191/2C. Provide latch with provision for locking gate with padlock.

   b. Sliding Gates: Provide manufacturer's standard rubber-tired rollers and roller track for floor-supported sliding gates. Include intermediate rollers or casters where required to prevent gate sag or deflection. Provide locking device and padlock eyes as part of latch for locking gate with padlock.

O. Pipe Sleeves: Pipe sleeves for fence post embedment in concrete curbs, barriers, and walls shall be fabricated from steel pipe conforming to ASTM A53 and galvanized in accordance with ASTM 123, sized to receive and support fence posts.

2.02 CONCRETE

A. Provide concrete footings for fence posts under this Section. Concrete for posts shall have a minimum compressive strength at 28 days of 3,000 psi, using one-inch maximum size aggregate and five sacks of cement minimum per cubic yard, with a maximum slump of four inches. Concrete and grout materials, placing, and curing shall conform to the applicable requirements of Section 03 30 00, Cast-In-Place Concrete, and Section 03 61 11, Non-Shrink Grout, respectively.

PART 3 – EXECUTION

3.01 PREPARATION

A. Installation of fencing shall not be started until final grading has been completed.

B. Locate fencing correctly as indicated.

C. Where posts are indicated or required to be embedded or set in concrete curbs, traffic barriers, or retaining walls, coordinate the installation of fencing closely with the installation of concrete as specified under Division 3 Concrete.

D. Furnish galvanized steel pipe sleeves for fence posts, as applicable, for installation in formwork at time required. Supervise installation of sleeves during formwork and placing of concrete to maintain exact dimensions according to template.

3.02 INSTALLATION

A. Install fencing and gates as indicated, in accordance with approved Shop Drawings, and applicable requirements of ASTM F567 and CLFMI Standards for Chain Link Fence Installation. Site fabricate as required to complete the fence installation.

B. Posts shall be plumb and rigid after installation. Rails shall be straight and tight. Chain link fabric shall be smooth and uniformly stretched tight and straight. Tension wires and barbed wires shall be pulled taut. Redwood slats in Type RP fence shall be straight and plumb.

C. Drill holes for post footings in firm, undisturbed or compacted soil. Footing holes shall be not less than nine inches in diameter and 38 inches in depth. Post embedment in concrete shall be 36 inches. Excavate deeper as required for adequate support in soft and loose soils, and for posts with heavy lateral loads.

D. Where posts are indicated or required to be embedded or set in concrete curbs, traffic barriers, or retaining walls, grout or seal posts in sleeves as indicated.

E. Gates shall be installed plumb, level, and secure for full opening without interference. Install ground-set items in concrete for anchorage as recommended by the fence manufacturer. Adjust hardware for smooth operation and lubricate. Sliding gates shall operate smoothly and easily under minimum pressure.

F. Locate and install safety and restriction signs securely as indicated on the Contract Drawings.

3.03 CONCRETE

A. Handling and placing of concrete shall conform to the applicable requirements of Section 03 30 00, Cast-In-Place Concrete.

B. Place concrete around posts in a continuous pour. Check each post for plumb and vertical and top alignment, and hold in position during placement and finishing operations.

C. C. Trowel finish tops of footings, and slope or dome to direct water away from posts. Set keepers, stops, sleeves, tracks, eye bolts, and other accessories into concrete as required. Wheel rolling area for sliding gates shall be steel-trowel smooth finish concrete.

3.04 ELECTRICAL GROUNDING

A. Where a power line carrying more than 600 volts passes over fence, install ground rod at the nearest point directly below each point of crossing. Ground all fences and gates and perform other electrical grounding as indicated. Coordinate with the requirements of Section 26 05 26, Grounding and Bonding for Electrical Systems.

END OF SECTION 32 31 13